

# Tests of doubling TPC cell size to reduce memory use by the tracker

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# Doubling the TPC cell size - memory reduction

Haiwang showed today in the sims meeting that memory usage for the tracking is dominated by the PHG4CylinderCellTPCReco module storage of cells.

To reduce memory usage for semi-central events, Haiwang increased the “phi” and “z” cell dimensions by a factor of 2, which reduced the memory by a factor of 2.25. I have done some tests of performance with the increased cell size.

After increasing the cell size to **0.12 x 0.17**, I changed the FitWindow to:

```
tpcclusterizer->setFitWindowMax(4/*rphibins*/,3/*zbins*/);
```

First, I ran interactively a central Hijing event with 100 embedded pions to see what maximum size is reached. The job stabilized at **6.7 GB resident** memory (with 100% CPU usage) and took 20 minutes to complete. Compare that with 15-20+ GB memory size when running with the default TPC cell size. **So a factor of ~3 reduction in memory size.**

# Doubling the TPC cell size - track efficiency

Just increasing the TPC cell size and changing the FitWindow parameters, without changing any other parameters, caused the track efficiency to drop from 98% to 90% in 100 pion events. Not all TPC layers had clusters.

So I also changed the clusterizer threshold from 0.1 to 0.05:

```
tpcclusterizer->setFitEnergyThreshold( 0.05 /*fraction*/ );
```

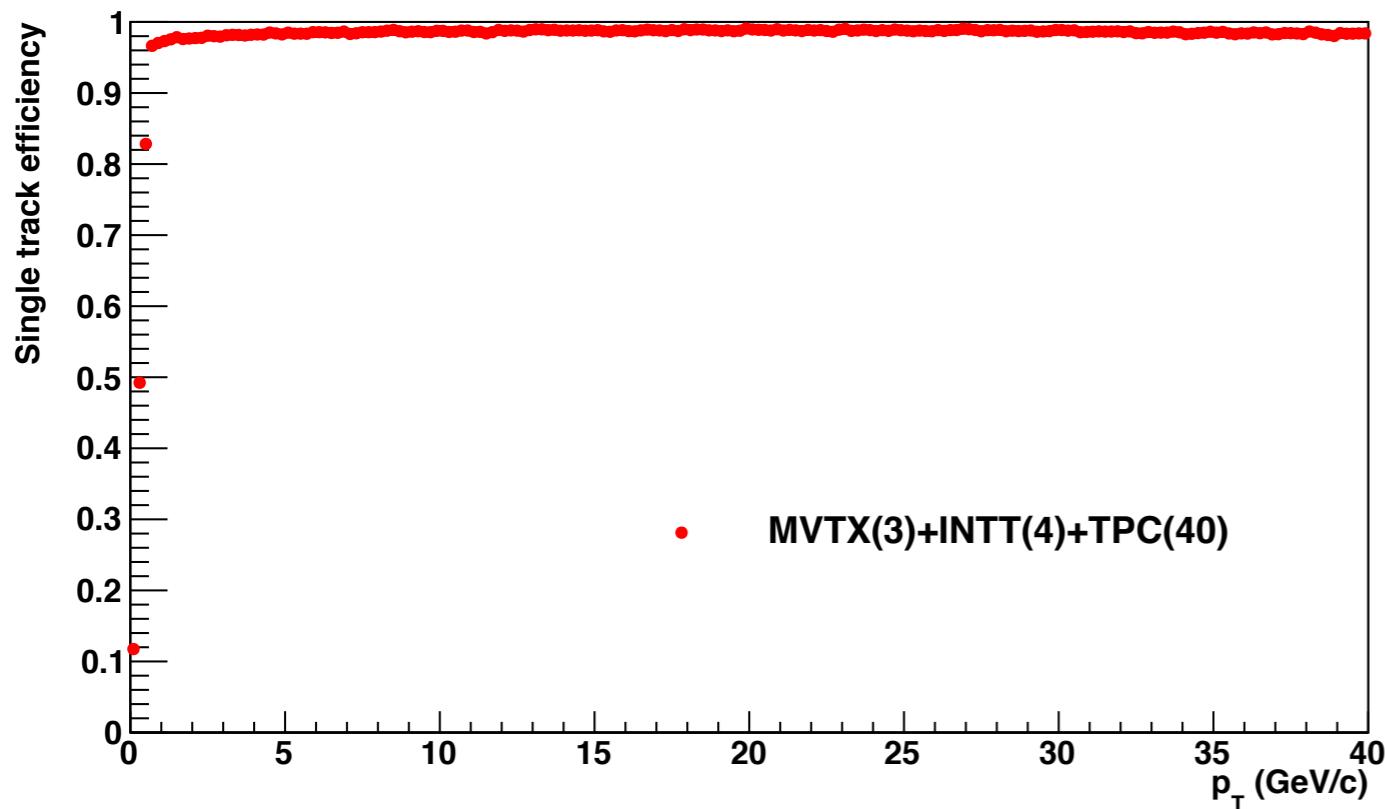
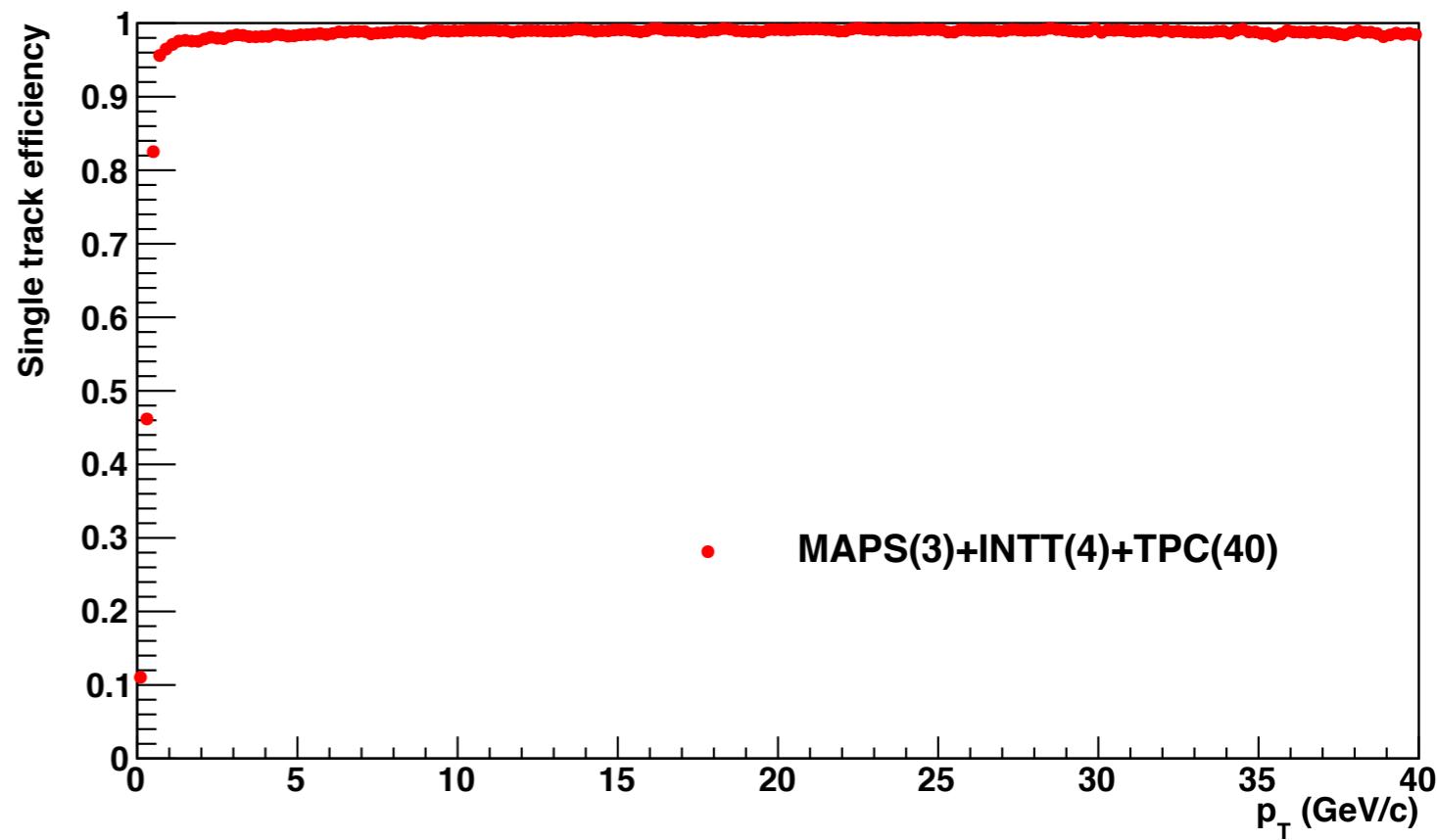
and that restored the efficiency to 98% in 100 pion events.

I ran 2,000 100 pion events in Condor to look at performance. See the following slides for a comparison of performance with the current default and the larger cell size.

These are for 100 pions + 1upsilon into  $-1 < \eta < 1$  and  $-5 \text{ cm} < Z < 5 \text{ cm}$ .

# Tracking efficiency - 100 pion events

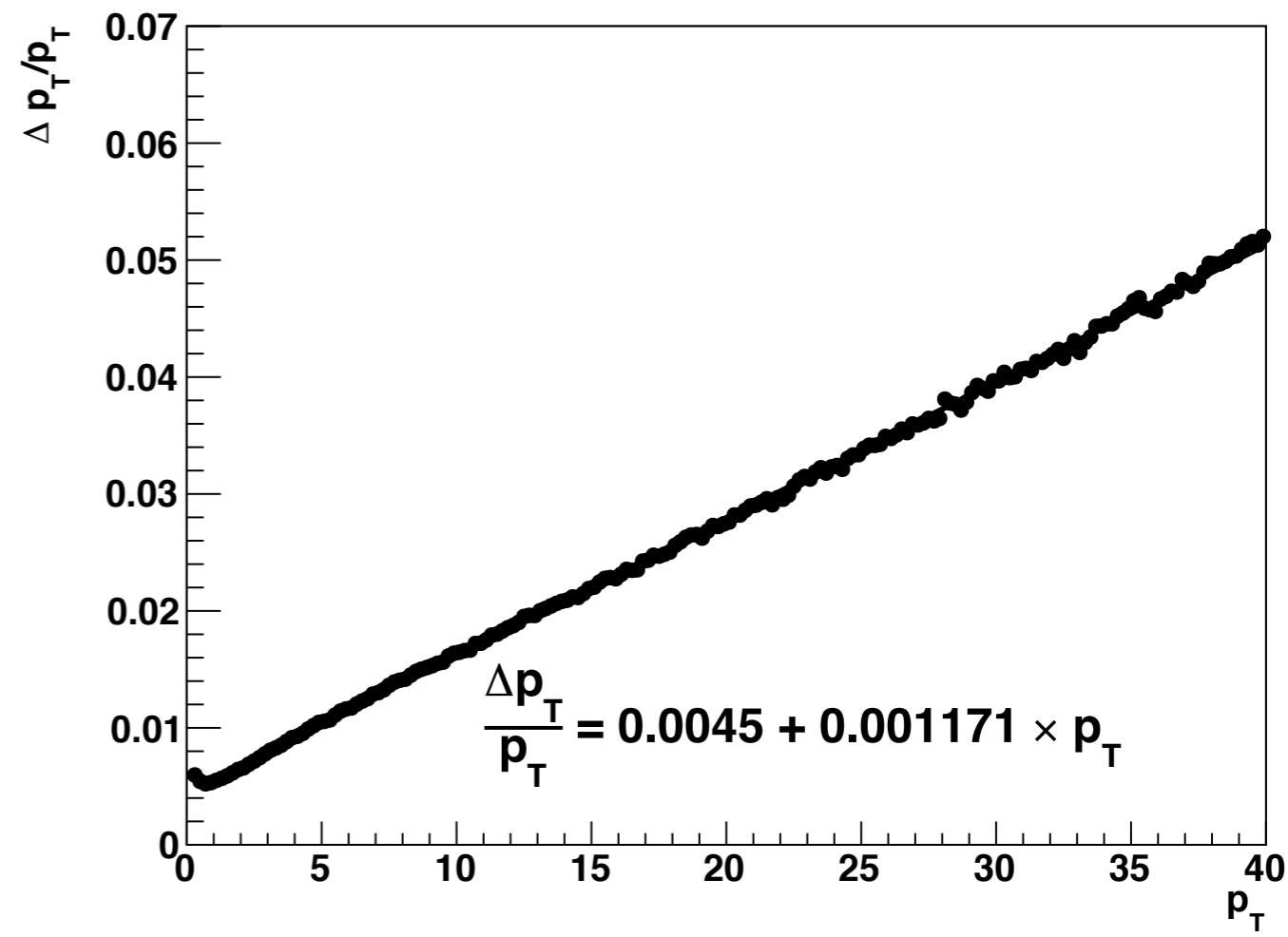
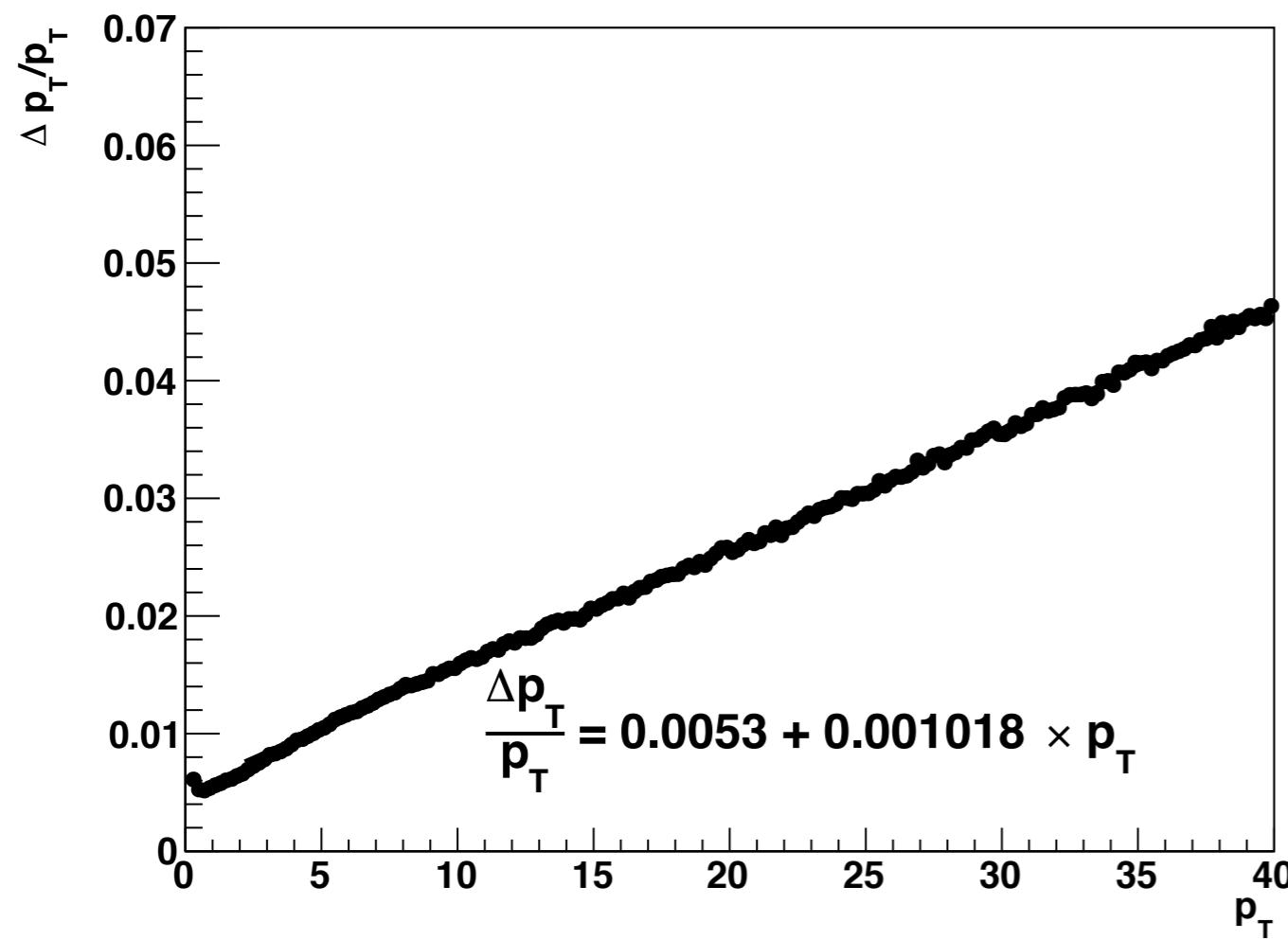
TPC cell size  
 $0.12/2 \times 0.17/2$



TPC cell size  
 $0.12 \times 0.17$

# $p_T$ resolution - 100 pion events

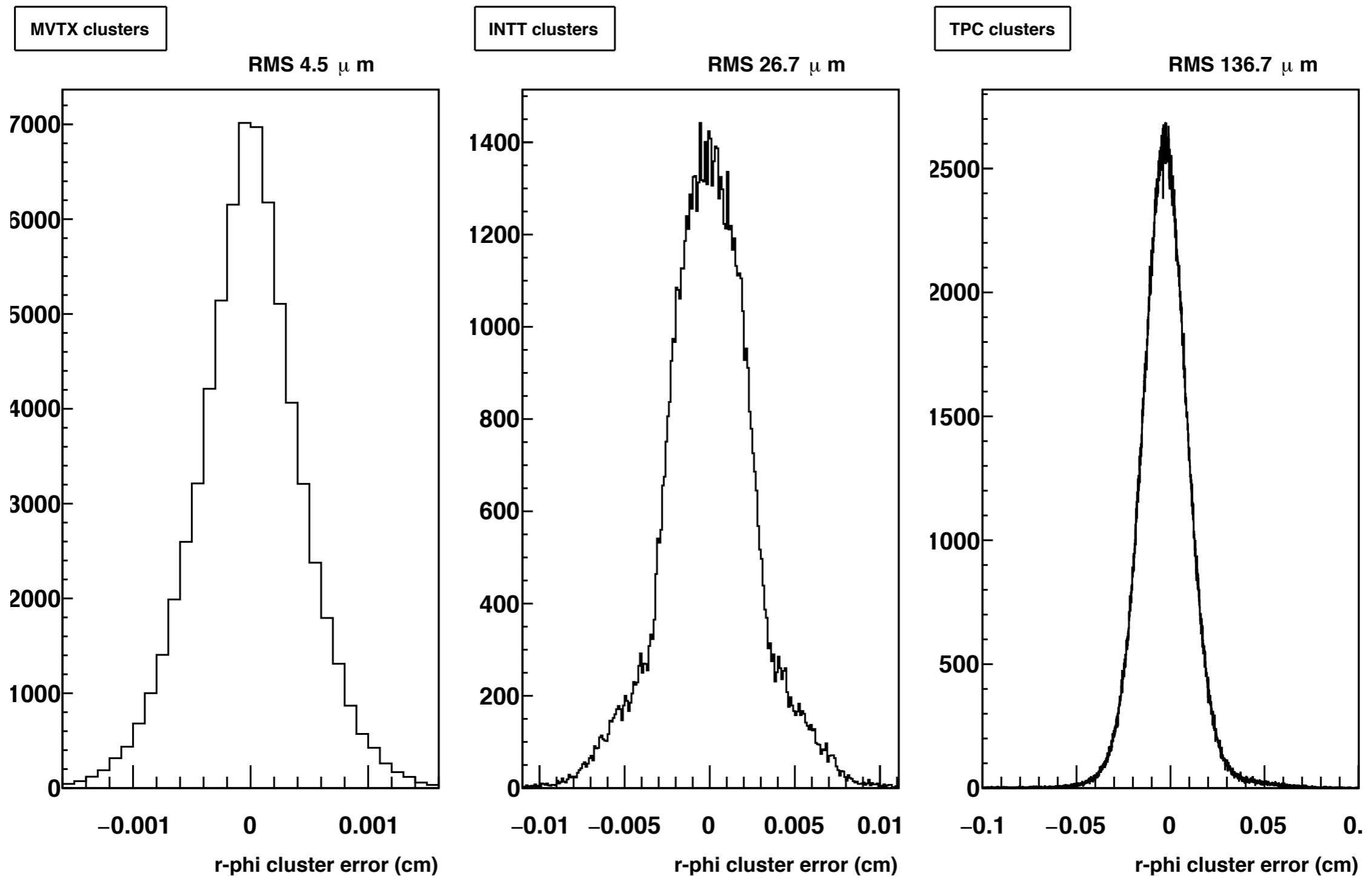
TPC cell size  
0.12/2 x 0.17/2



TPC cell size  
0.12 x 0.17

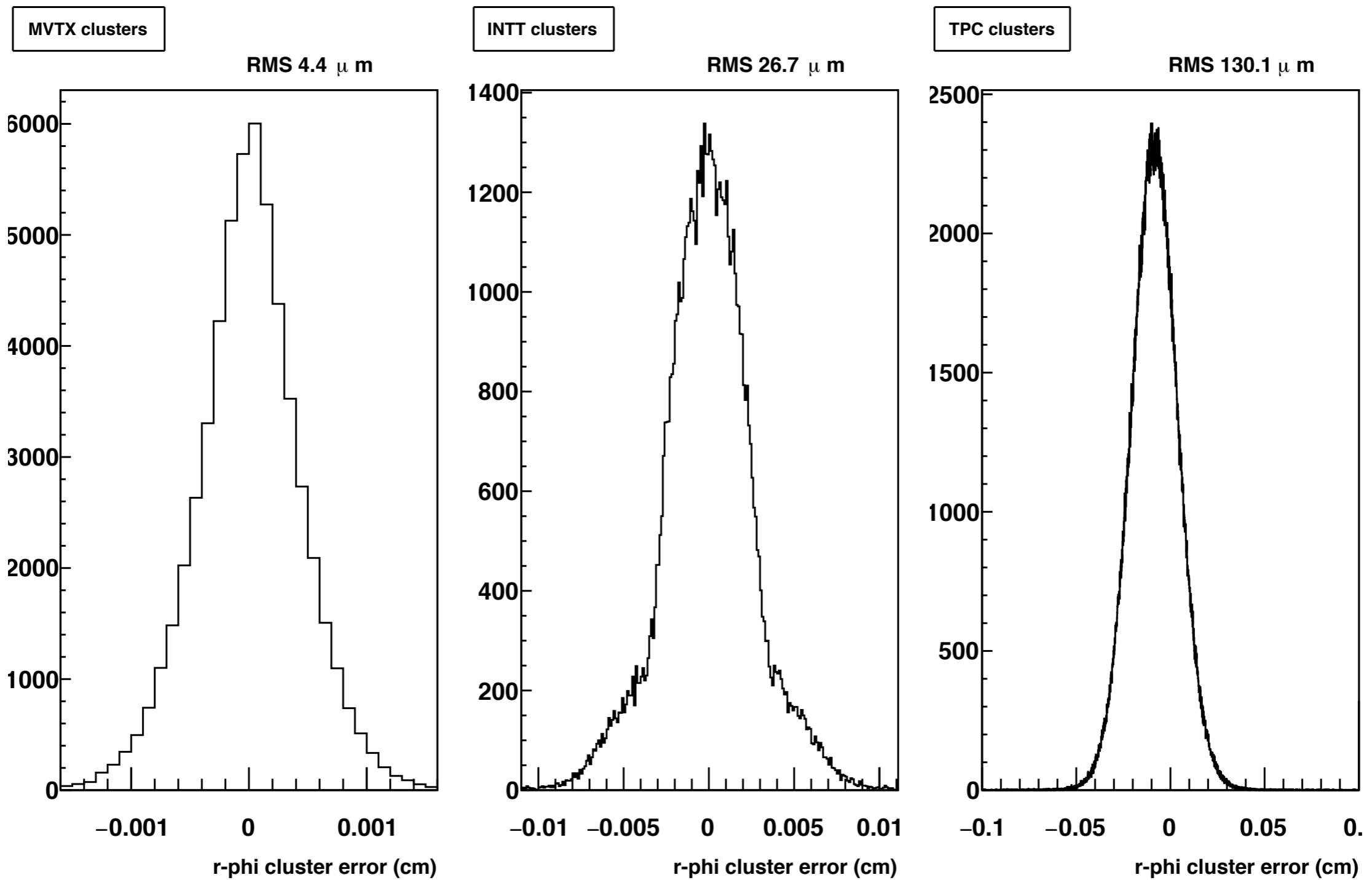
# Cluster r- $\phi$ resolution - 100 pion events

TPC cell size 0.12/2 x 0.17/2



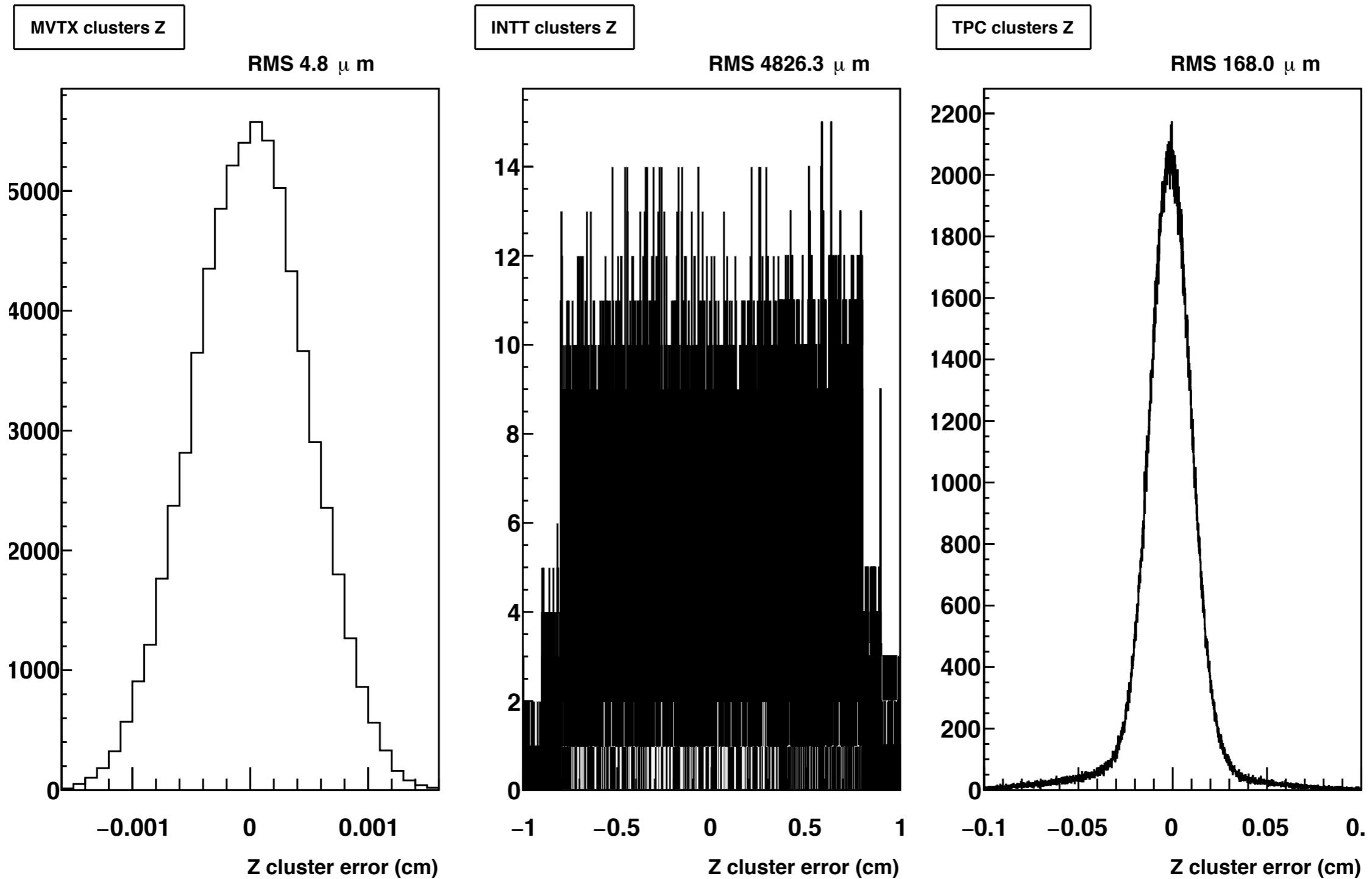
# Cluster r- $\phi$ resolution - 100 pion events

TPC cell size 0.12 x 0.17



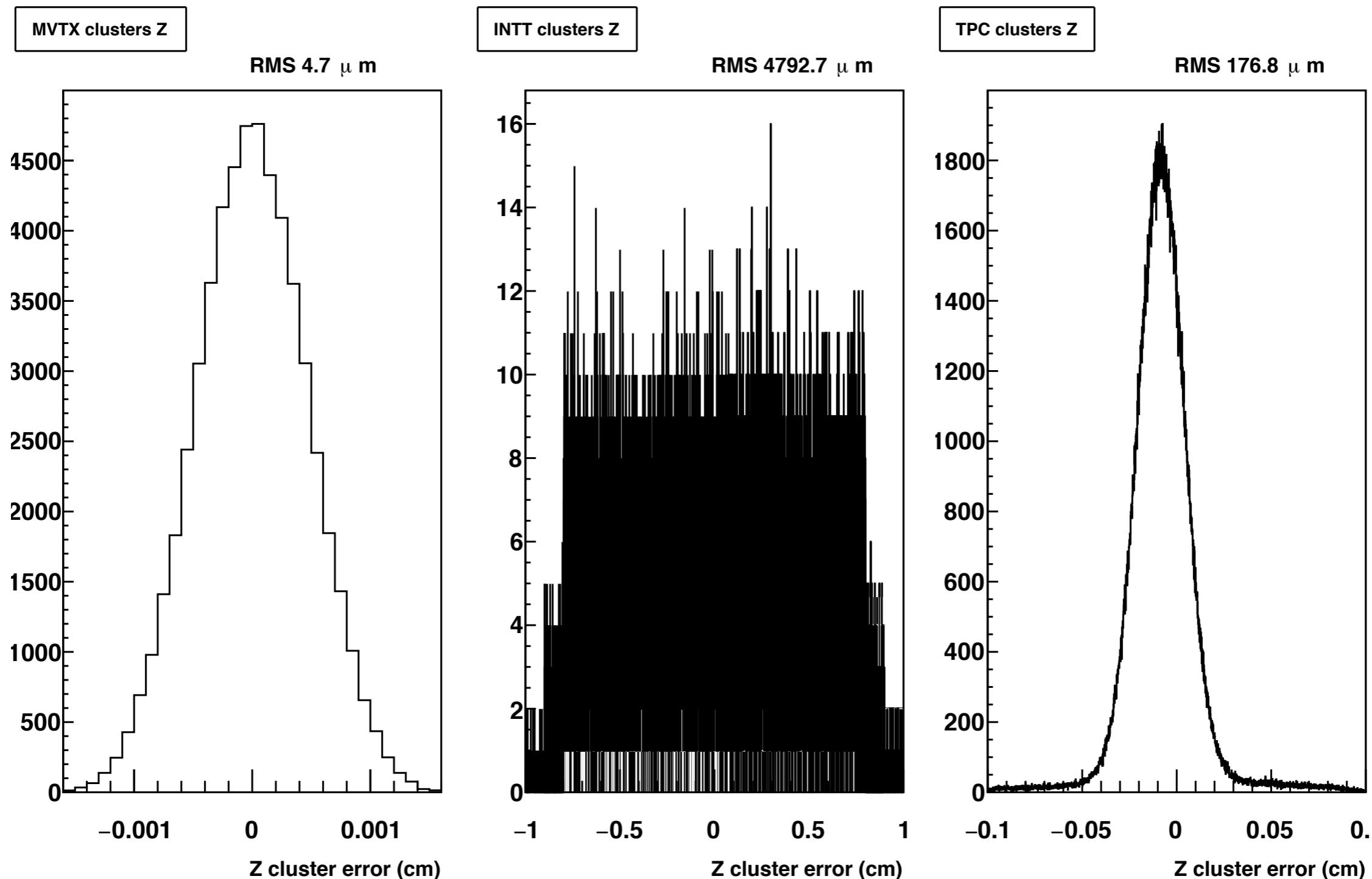
# Cluster Z resolution - 100 pion events

TPC cell size 0.12/2 x 0.17/2



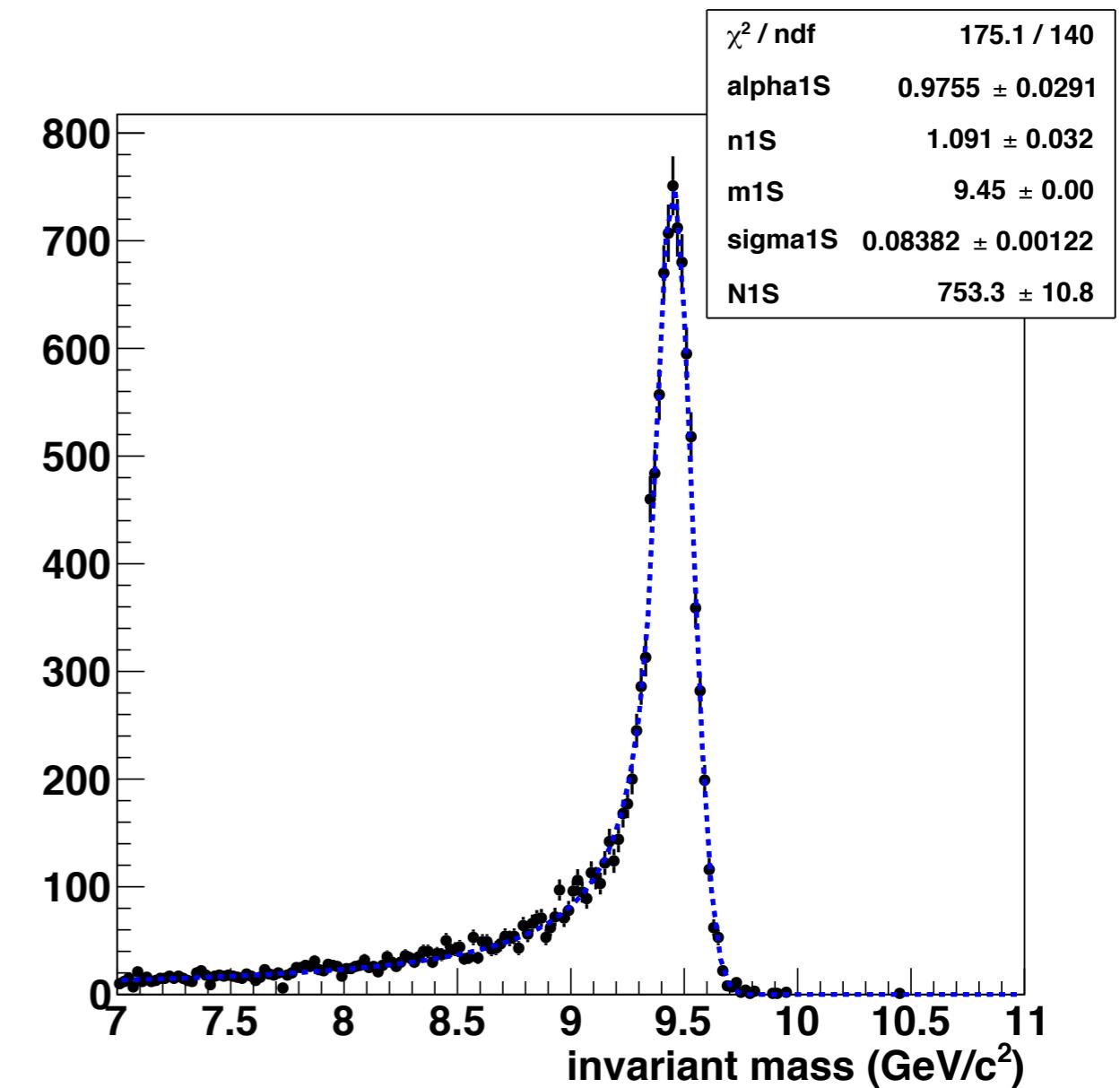
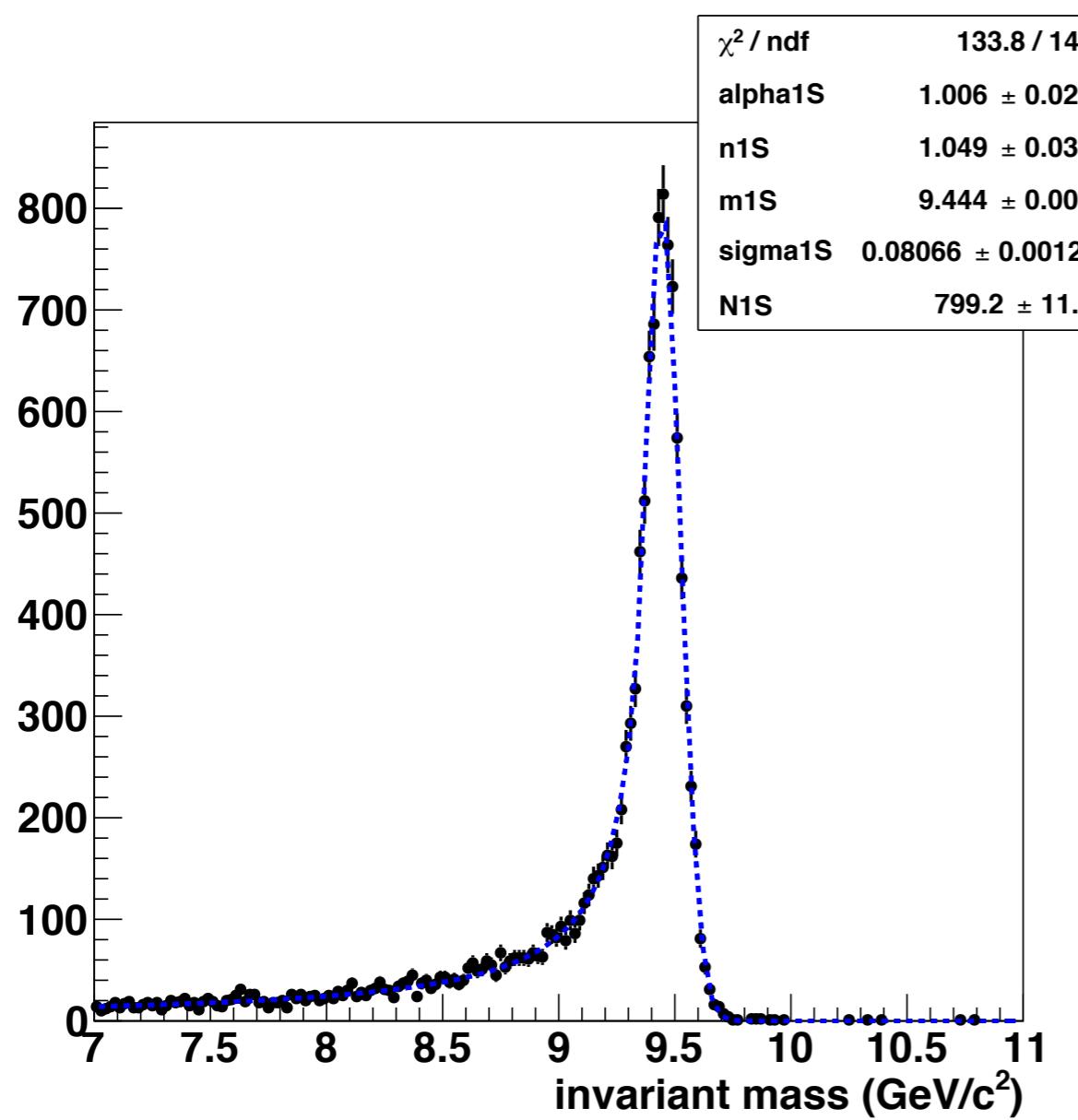
# Cluster Z resolution - 100 pion events

TPC cell size  $0.12 \times 0.17$



# $\Upsilon(1S)$ mass - 100 pion events + 1 $\Upsilon(1S)$

TPC cell size  $0.12/2 \times 0.17/2$



TPC cell size  $0.12 \times 0.17$